

# PATENT COOPERATION TREATY

to the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

## PCT

WRITTEN OPINION  
(PCT Rule 66)

To:

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Montréal, Québec, Canada H2Y 3X2  
CANADA

ACT 14/7

*Handwritten signature/initials*

Date of mailing  
(day/month/year)

24.06.2004

Applicant's or agent's file reference  
000677-0032

**REPLY DUE**

**within 3 month(s)**  
from the above date of mailing

International application No.  
PCT/CA 03/01070

International filing date (day/month/year)  
16.07.2003

Priority date (day/month/year)  
16.07.2002

International Patent Classification (IPC) or both national classification and IPC  
C12P3/00

Applicant  
CO2 SOLUTION INC. et al.

1. This written opinion is the **first** drawn up by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
  - I ☒ Basis of the opinion
  - II ☐ Priority
  - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV ☐ Lack of unity of invention
  - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI ☐ Certain documents cited
  - VII ☐ Certain defects in the international application
  - VIII ☐ Certain observations on the international application
3. The applicant is hereby **invited to reply** to this opinion.
 

**When?** See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

**How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

**Also:** For an additional opportunity to submit amendments, see Rule 66.4.  
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.  
For an informal communication with the examiner, see Rule 66.6.

**If no reply is filed,** the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 16.11.2004

Name and mailing address of the international preliminary examining authority:



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**I. Basis of the opinion**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed"*):

**Description, Pages**

1-7 as published

**Claims, Numbers**

1-14 as published

**Drawings, Sheets**

1/2-2/2 as published

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

6. Additional observations, if necessary:

**see separate sheet**

**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	1-14: Yes
Inventive step (IS)	Claims	1-14: No
Industrial applicability (IA)	Claims	1-14: Yes

**2. Citations and explanations****see separate sheet**

### Re Item I

## Basis of the opinion

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Reference is made to the following documents:

**D1:** WO 98 55210 A (BLAIS R ;ROGERS P A (CA); SYSTEMES ENVIROBIO INC (CA)) 10 December 1998, **cited** in the application;

**D2:** DATABASE CA [Online] CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; 12 August 1978, TABATA, H et al.: 'Separation of Calcium from a Solution Containing Calcium and Magnesium' Database accession no. 89:61929 XP2260760 & JP 52 138477 A (KINKAI KAISUI KOGYO KK) 18 November 1977;

**D3: US-B1-6 387 212 (CHRISTIAN R) 14 May 2002;**

**D4: CA-A-2 352 626 (CO2 SOLUTION INC) 12 January 2003;**

**D5:** SHIMOMURA, N et al.: 'Control of the production amount and polymorphism of calcium carbonate by biomimetic mineralization' CHEMISTRY LETTERS, vol. 31, no. 9, September 2002, pages 902-903, XP9019773.

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1. The application discloses (the references in parentheses applying to this document) a process for producing  $\text{CaCO}_3$  comprising (1) catalysing the hydration of  $\text{CO}_2$  contained in a gas by means of an enzyme (carbonic anhydrase), thereby producing a solution containing bicarbonate ions and hydrogen ions; (2) reacting the bicarbonates with calcium ions; and (3) precipitating the  $\text{CaCO}_3$  obtained (claims 1-8). The application discloses as well an apparatus for producing  $\text{CaCO}_3$  according to said process (claims 9-14).
2. The priority document in respect of the present application is at present not available to the International Preliminary Examination Authority. In consequence the current assessment is based on the assumption that all claims enjoy priority rights from the filing date of the priority document. If it later turns out that this is not correct, the documents **D4** and **D5** cited in the international search report could become relevant.
- 2.1 Document **D4** discloses (the references in parentheses applying to this document) gaseous  $\text{CO}_2$  emissions from processes such as hydrocarbon reforming are transfor-

med into carbonate or bicarbonate ions and hydrogen ions by the enzymatic system in order to prevent their contribution to the greenhouse effect (Abstract, examples 1 and 2).

- 2.2 Document **D5** discloses (the references in parentheses applying to this document) the cooperation between carbonic anhydrase (CA) as a catalyst for the conversion of  $\text{CO}_2$  to  $\text{HCO}_3^-$ , and poly(L-aspartate) as calcium ion recognition sites, induced the aragonite formation of calcium carbonate. The higher CA-arising activity promoted the calcium carbonate production (Abstract).

**Re Item V**

**Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

- 1 The document **D2**, which is considered to represent the most relevant state of the art, discloses (the references in parentheses applying to this document) the formation of  $\text{CaCO}_3$  by precipitation of the product obtained by mixing  $\text{NaHCO}_3$  and dissolved Calcium (abstract).
- 2 The subject-matter of claims 1 and 9 therefore **differs** from this known process in that the  $\text{CO}_2$  contained in a gas is first hydrated by means of a catalyst capable of catalysing the hydration of dissolved  $\text{CO}_2$  into hydrogen ions and bicarbonate ions.
- 3 The subject-matter of **claims 1 and 9** and of their dependant claims **2-8** and **10-14** is therefore **new**. Claims 1-14 comply with the requirements of Article 33(2) PCT.
- 4 The **problem** to be solved by the present invention may therefore be regarded as to find an alternative way of forming calcium carbonate.
- 5 The **solution** proposed in claim 1 of the present application cannot be considered as

involving an inventive step (Article 33(3) PCT) for the following reasons:

- 5.1 Document **D1** discloses (the references in parentheses applying to this document) a bioreactor/process for removing CO<sub>2</sub> from a CO<sub>2</sub>-containing gas, characterized in that it comprises the step of: (a) contacting the CO<sub>2</sub>-containing gas with an aqueous liquid in a bioreactor containing immobilized carbonic anhydrase or an analog thereof, the carbonic anhydrase catalysing the hydration of the CO<sub>2</sub>, thereby producing hydrogen ions and bicarbonate ions (claims 1 and 9).  
Thus by combining the process of **D1** to the teaching of **D2**, the skilled person would solve the problem posed without the exercise of inventive skill. Thus, the subject-matter of claims 1, 3, 5, 9 and 11 does not involve an inventive step and does not satisfy the criterion set forth in Article 33(3) PCT.
- 5.2 Document **D3** discloses a process for obtaining fibres integral with calcium carbonate particles, which comprises: preparing a first composition comprising calcium bicarbonate; preparing a second composition comprising calcium hydroxide; and mixing the first and second compositions in the presence of said fibres thereby precipitating calcium carbonate particles in contact with at least some of said fibres; Thus, the subject-matter of claim 2 is obvious for the skilled person;  
Dependent claims 4, 6-8, 10 and 12-14 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of r inventive step.
- 5.3 Therefore, the subject-matter of claims 1-14 does not comply with the requirements of Article 33(3) PCT.
6. The subject-matter of **claims 1-14** complies with the requirements of Article 33(4) PCT, because the process according to claim 1 and/or the apparatus according to claim 9 have an **application** for producing CaCO<sub>3</sub>.

**Further deficiencies of the Application:**

1. Claims 1 and 10 do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The claims attempt to define the subject-matter in terms of the result to be achieved ("enzyme(s) capable of catalysing the hydration of dissolved CO<sub>2</sub> into hydrogen ions and bicarbonate ions") which merely amounts to a statement of the underlying problem. The technical features necessary for achieving this result should be added.
2. Claim 9 does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The following functional statements do not enable the skilled person to determine which technical features are necessary to perform the stated functions: "catalysing means", "reacting means", and "precipitating means".
3. The feature of claim 5, that an "enzyme" is immobilized, is not referred to in the description, which discloses that "carbonic anhydrase" is immobilized (page 5, line 23 and page 7, line 8). Claim 5 is therefore not supported by the description as required by Article 6 PCT.  
All the feature of claims 9-14 are not referred to in the description. Claims 9-14 are therefore not supported by the description as required by Article 6 PCT.
4. There are spelling mistakes in the application:  
Claim 1 and page 2, line 24: "charaterized"